

PHY132S Relativity  
Class 3 - March 30 2009

$$\underline{\Delta t = \gamma \Delta t'}$$

Remember:

- ① muons live longer
- ② astronaut twin younger

Relativistic Doppler Effect (§90.7)

light' observer always stationary  
wrt "medium"

$$\lambda_{\text{Pablo}} = (c + v)T \quad \text{as before}$$

$$T = \gamma T_0$$

$T_0$  - period wrt observer  
for whom source  
at rest

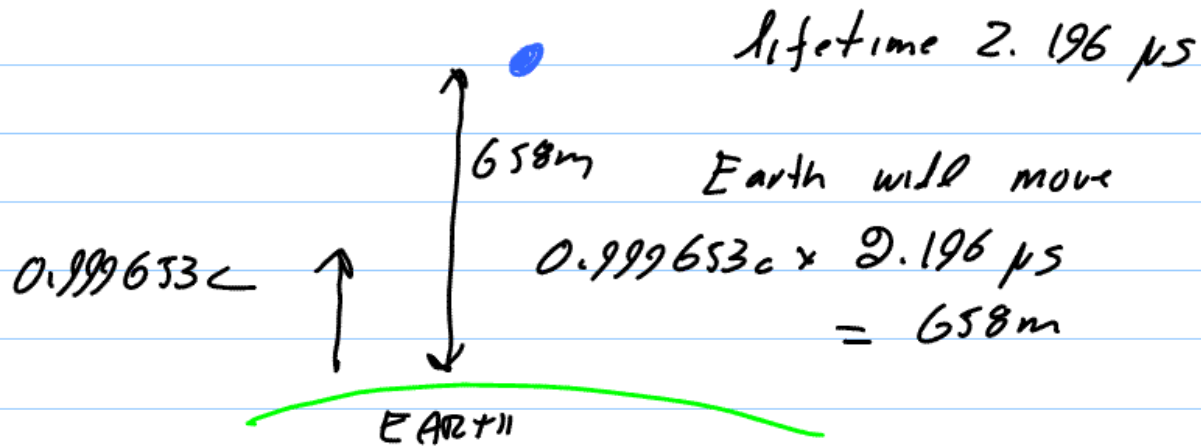
SCN Problem 2 - fill in details

§37.7

Length Contraction

Muons

muon frame



$L_0 =$  "rest length"

$$L = \sqrt{1 - \beta^2} L_0$$

§37.5

Simultaneity

SCN §C

2 events:

$\Delta t$ : time between events

$\Delta x$ : distance " "

$$\Delta t_{Sue} \neq \Delta t_{Lou}$$

$$\Delta x_{Sue} \neq \Delta x_{Lou}$$

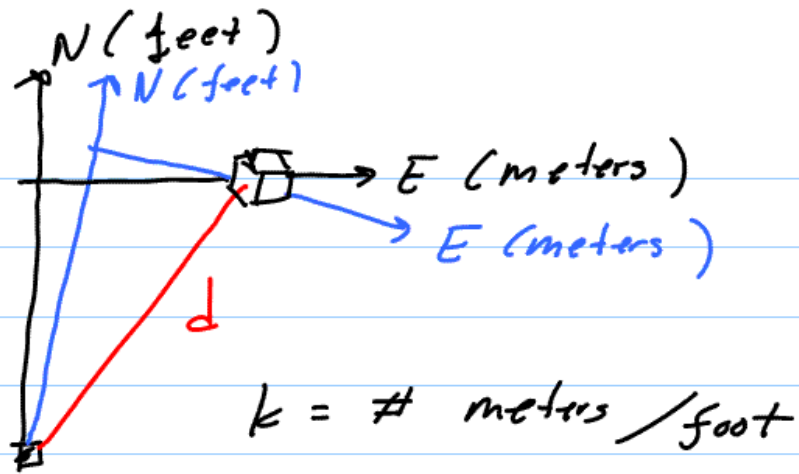
Anything constant? YES

$$\boxed{(c \Delta t_{Sue})^2 - (\Delta x_{Sue})^2 = (c \Delta t_{Lou})^2 - (\Delta x_{Lou})^2} \quad (37.19)$$

$$\equiv s^2$$

$s \equiv$  "interval"

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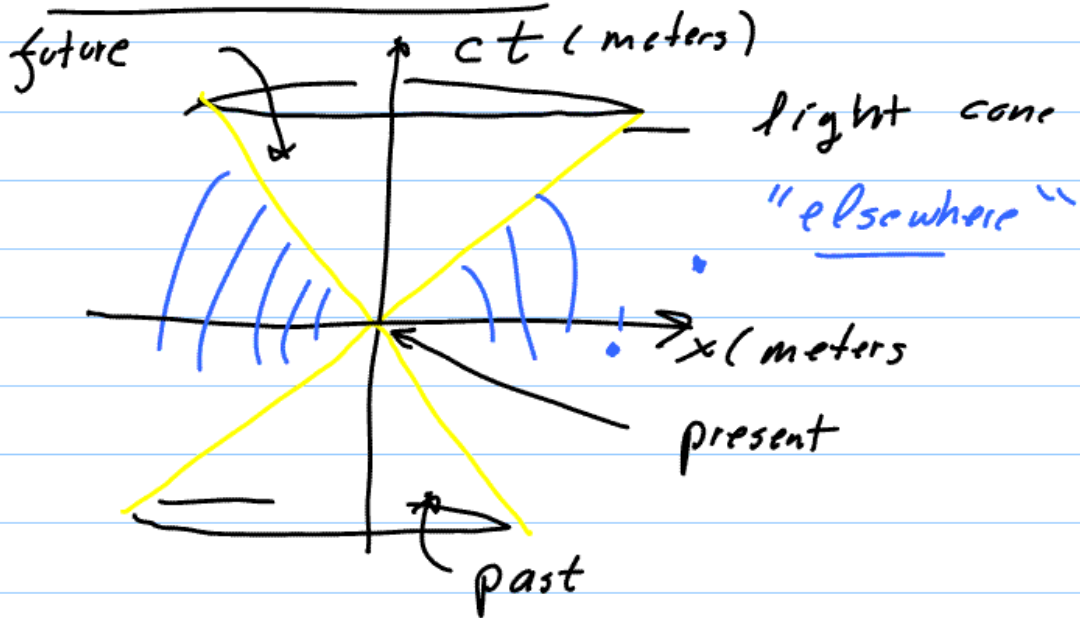
$$\begin{aligned}
 (kN)^2 + (E)^2 \\
 &= (kN)^2 + (E)^2 \\
 &= d^2 \quad d \equiv \text{distance}
 \end{aligned}$$

Time 4<sup>th</sup> dimension  
 (almost) equal status  
 to  $x, y, z$

$c$ : just converts seconds  
 to meters



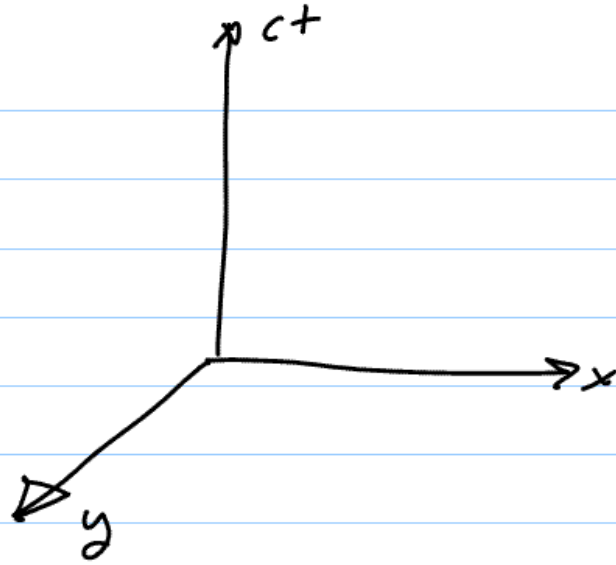
## Spacetime Diagram



SCN §6.3

Surveyors! coords rotated

SCN §6.4



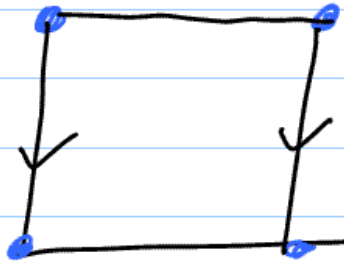
Point 0D



Line 1D



Square 2D



Cube 3D

